

**15298**  
Regolith Breccia  
1731 grams



Figure 1: PET photograph of 15298. Cube is 1 inch.  
S71-43041

### Introduction

15298 is a brown glass matrix breccia from station 6, Apollo 15, broadly similar to 15295 and 15299 and numerous other breccias returned from this site. Fractures in 15298 have slickensides (figure 1).

### Petrography

A careful modal analysis of both the coarse and fine fractions of 15298 is provided by McKay et al. (1989) and compared with other regolith breccias. They report 13% agglutinates in the coarse fragments and 53% vitric component in the fine fraction (<500 microns). They also disaggregated the sample by freeze-thaw cycles and performed a grain size analysis. A small chip (8 mg) was used to determine the rare gas content and maturity index ( $I_s/\text{FeO} = 59$ ). The high solar-wind, rare-gas content, high  $I_s/\text{FeO}$  and agglutinate content show that this breccia, and the others like it, was formed from compressed lunar soil. Since the chemical composition matches the local soil, the breccia probably was locally derived (Spur Crater?).

The Apollo 15 catalog by Ryder (1985) contains additional information.

### Chemistry

Christian et al. (1976) and Korotev in McKay et al. (1989) have provided an analysis of the matrix of 15298 (table 1, figure 8). The high KREEP component was noted by the analysts.

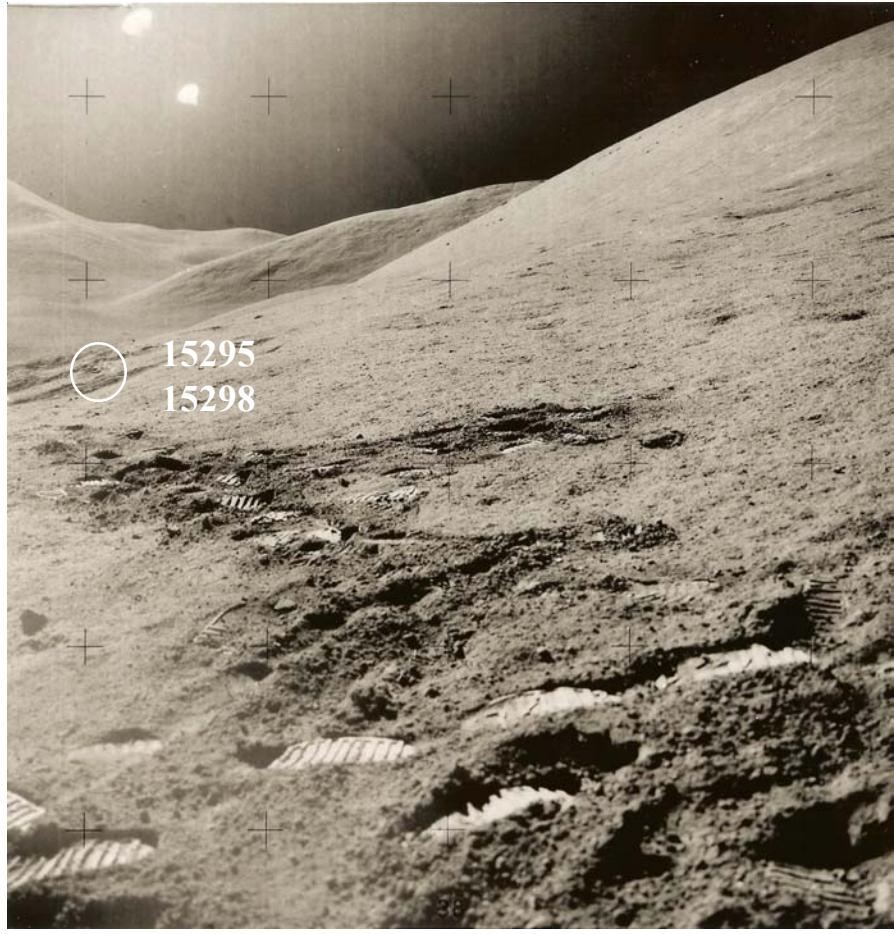
Moore et al. ('1973) determined 130 – 160 ppm carbon for 15298 (figure 6).

### Other Studies

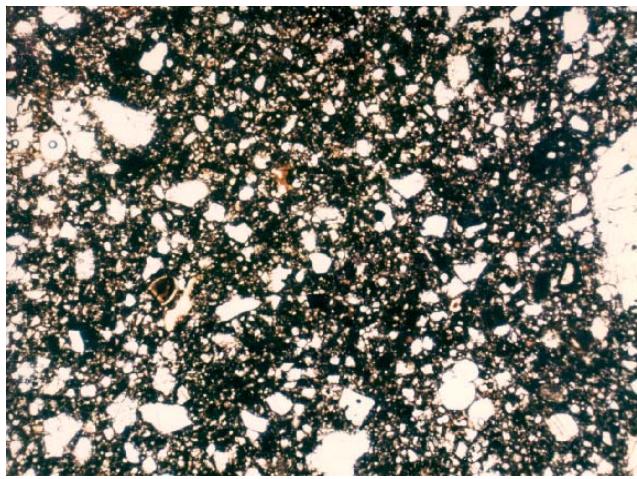
Moore et al. (1973) reported 145 ppm carbon in 15298, verifying that it is a soil breccia. Flory et al. (1972) studied the release of carbon compounds in 15298.

### **Mineralogical Mode for 15298**

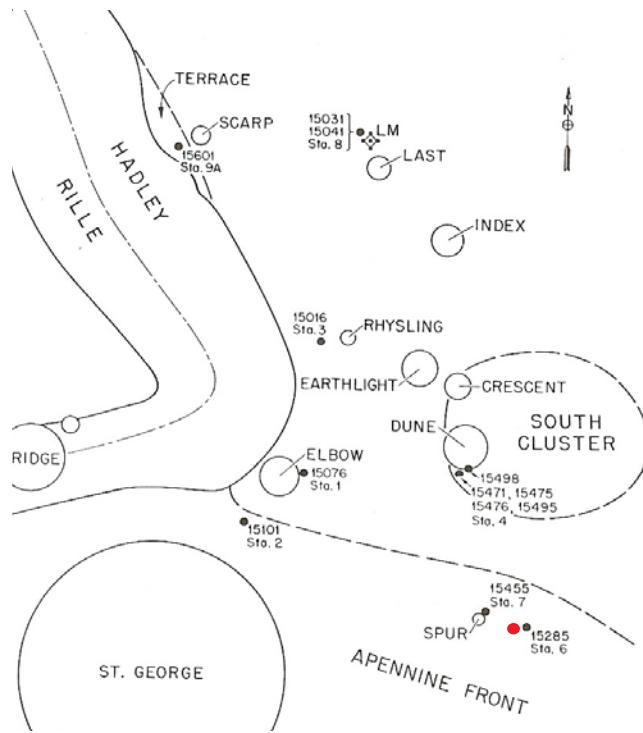
	(McKay et al. 1989)	20-500 micron	500-1000 micron
Mare Basalt	2.7 %	18.4 %	
KREEP basalt	1	0	
Plutonic	0	0	
Breccias	4	12.3	
Olivine	0.7	-	
Pyroxene	28	7.9	
Plagioclase	16.3	-	
Opacites	-	0	
Glass	12.7	21	
Agglutinates	13	0	



*Figure 2: Surface photo showing location of 15298. AS15-85-11516*



*Figure 3: Photomicrograph of thin section of 15298. Field of view is 2.4 mm.*



*Figure 4: Location of 15298 on map of Apollo 15 site.*

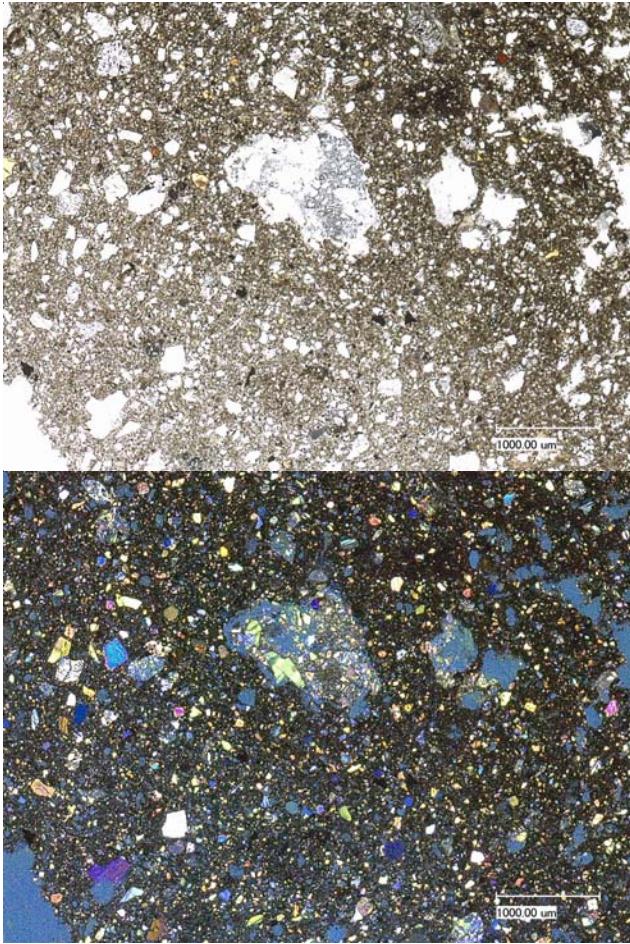


Figure 5: Photomicrographs of thin section of 15298.

Bogard and Nyquist (1972) and Bogard in McKay et al. (1989) reported detail rare gas analysis and concluded that “15298 must have existed on the surface for most of its exposure” due to high  $^{131}\text{Xe}$ .

### Processing

There are 6 thin sections of 15298.

■ Rock

□ CMB

○ Regolith Breccia

● soil

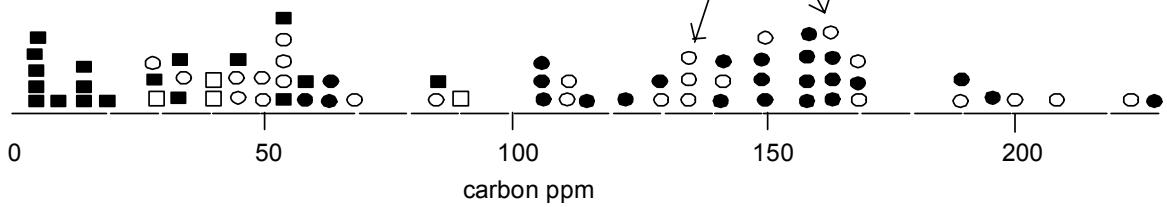


Figure 6: Carbon content of Apollo 15 samples.

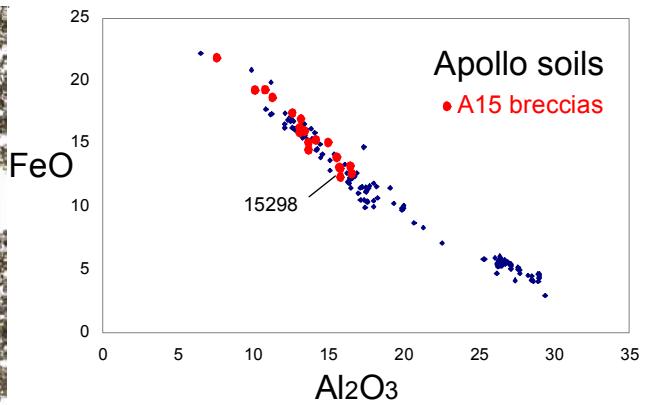


Figure 7: Composition of 15298 compared with Apollo soils and Apollo 15 breccias.

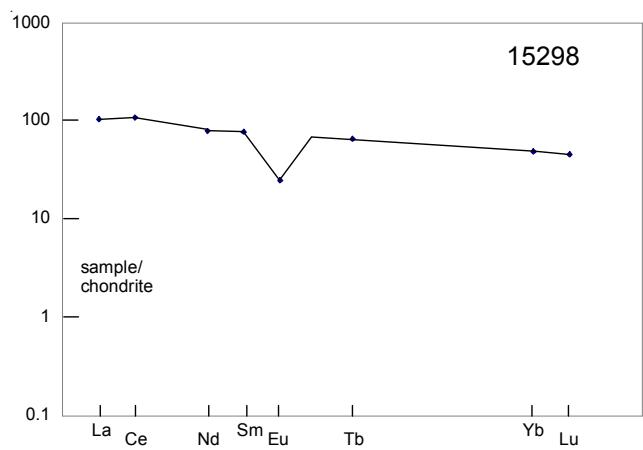


Figure 8: Normalized rare-earth-element composition diagram for 15298 (data from Korotev, see McKay et al. 1989).

**Table 1. Chemical composition of 15298.**

reference McKay 89 Christian 76

*weight*

SiO <sub>2</sub> %		45.97	(b)
TiO <sub>2</sub>	1.5	(a) 1.52	(b)
Al <sub>2</sub> O <sub>3</sub>	15.8	(a) 15.93	(b)
FeO	13.1	(a) 12.96	(b)
MnO	0.17	(a) 0.2	(b)
MgO	11.1	(a) 10.96	(b)
CaO	10.5	(a) 11.03	(b)
Na <sub>2</sub> O	0.46	(a) 0.8	(b)
K <sub>2</sub> O		0.17	(b)
P <sub>2</sub> O <sub>5</sub>		0.15	(b)

S %

*sum*

Sc ppm	24.4	(a) 25	(b)
V	85	(a) 62	(b)
Cr	2390	(a) 1984	(b)
Co	42.5	(a) 44	(b)
Ni	243	(a) 200	(b)
Cu		12	(b)
Zn		13	(b)
Ga		4.3	(b)

Ge ppb

As

Se

Rb		5.3	(b)
Sr	150	(a) 140	(b)
Y		90	(b)
Zr	390	(a) 440	(b)
Nb		25	(b)

Mo

Ru

Rh

Pd ppb

Ag ppb

Cd ppb

In ppb

Sn ppb

Sb ppb

Te ppb

Cs ppm	0.26	(a)	
Ba	246	(a) 330	(b)
La	24.7	(a) 15	(b)
Ce	66	(a)	

Pr

Nd 36 (a)

Sm 11.5 (a)

Eu 1.4 (a)

Gd

Tb 2.4 (a)

Dy

Ho

Er

Tm

Yb	8	(a) 12	(b)
Lu	1.12	(a)	
Hf	9.2	(a)	
Ta	1.11	(a)	

W ppb

Re ppb

Os ppb

Ir ppb 8 (a)

Pt ppb

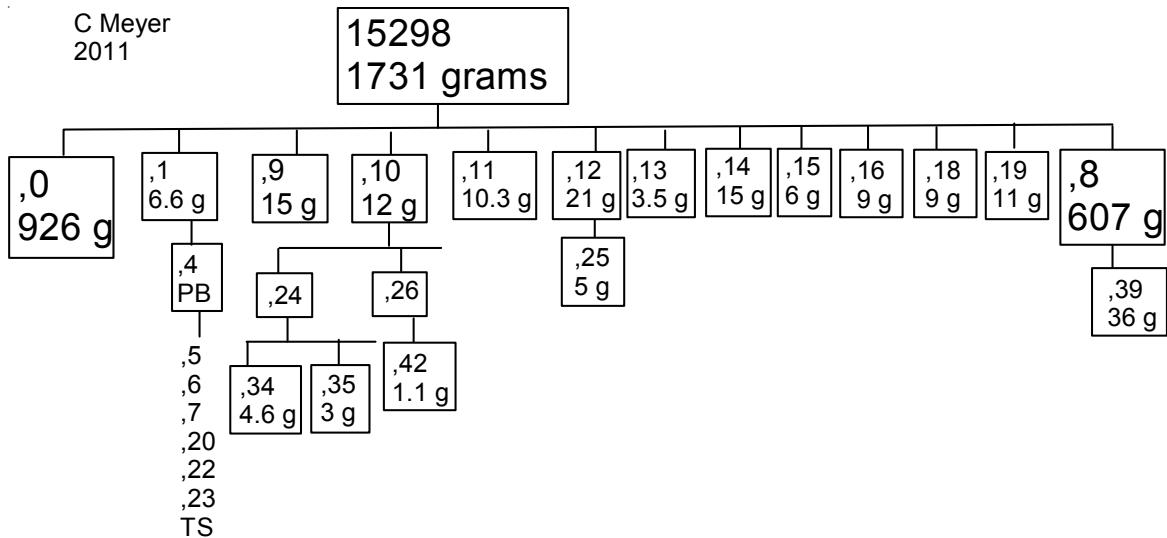
Au ppb 1.8 (a)

Th ppm 5.2 (a)

U ppm 1.2 (a)

technique (a) INAA, (b) combined XRF, semimicro chem., emission spec.

C Meyer  
2011



### References for 15298

- Best J.B. and Minkin J.A. (1972) Apollo 15 glasses of impact origin. In **The Apollo 15 Lunar Samples**, 34-39. Lunar Planetary Institute, Houston.
- Bogard D.D. and Nyquist L.A. (1972) Noble gas studies on regolith materials from Apollo 14 and 15. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1797-1819.
- Butler P. (1971) Lunar Sample Catalog, Apollo 15. Curators' Office, MSC 03209
- Christian R.P., Berman S., Dwornik E.J., Rose H.J. and Schnepfe M.M. (1976) Composition of some Apollo 14, 15 and 16 lunar breccias and two Apollo 15 fines (abs). *Lunar Sci. VII*, 138-140. Lunar Planetary Institute, Houston.
- Flory D.A., Oro J., Wikstrom S., Beaman D. and Noonan D. (1972) Analysis of organogenic compounds in Apollo 15 samples. In **The Apollo 15 Samples**, 275-279. Lunar Planetary Institute, Houston.
- McKay D.S., Morris R.V. and Wentworth S.J. (1984) Maturity of regolith breccias as revealed by ferromagnetic and petrographic indices (abs). *Lunar Planet. Sci. XV*, 530-531. Lunar Planetary Institute, Houston.
- McKay D.S., Bogard D.D., Morris R.V., Korotev R.L., Wentworth S.J. and Johnson P. (1989) Apollo 15 regolith breccias: Window to a KREEP regolith. *Proc. 19<sup>th</sup> Lunar Sci. Conf.* 19-41. Lunar Planetary Institute, Houston.
- Moore C.B., Lewis C.F. and Gibson E.K. (1972) Carbon and nitrogen in Apollo 15 lunar samples. In *The Apollo 15 Lunar Samples* (Chamberlain J.W. and Watkins C., eds.), 316-318. The Lunar Science Institute, Houston.
- Moore C.B., Lewis C.F. and Gibson E.K. (1973) Total carbon contents of Apollo 15 and 16 lunar samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1613-1923.
- Ryder G. (1985) Catalog of Apollo 15 Rocks (three volumes). Curatorial Branch Pub. # 72, JSC#20787
- Swann G.A., Hait M.H., Schaber G.C., Freeman V.L., Ulrich G.E., Wolfe E.W., Reed V.S. and Sutton R.L. (1971b) Preliminary description of Apollo 15 sample environments. U.S.G.S. Interagency report: 36. pp219 with maps
- Swann G.A., Bailey N.G., Batson R.M., Freeman V.L., Hait M.H., Head J.W., Holt H.E., Howard K.A., Irwin J.B., Larson K.B., Muehlberger W.R., Reed V.S., Rennilson J.J., Schaber G.G., Scott D.R., Silver L.T., Sutton R.L., Ulrich G.E., Wilshire H.G. and Wolfe E.W. (1972) 5. Preliminary Geologic Investigation of the Apollo 15 landing site. In Apollo 15 Preliminary Science Rpt. NASA SP-289. pages 5-1-112.
- Warren P.H., Jerde E.A. and Kallemeyn G.W. (1987) Pristine moon rocks: A large felsite and a metal-rich ferroan anorthosite. *Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* **90**, E303-E313.
- Wentworth S.J. and McKay D.S. (1984) Density and porosity calculations for Apollo 15 and 16 regolith breccias (abs). *Lunar Planet Sci. XV*, 906-907. Lunar Planetary Institute, Houston.